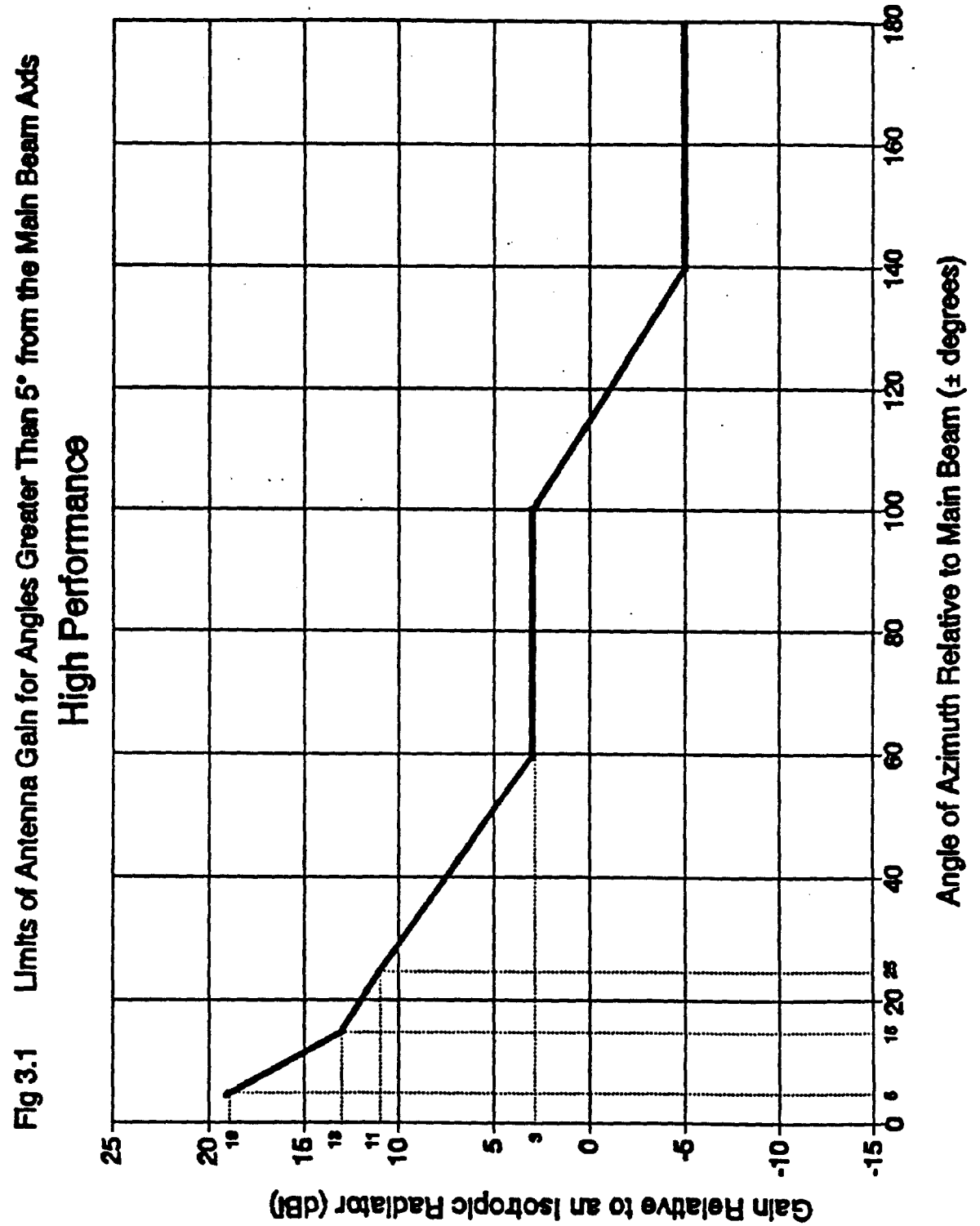


Fig 3.1 Limits of Antenna Gain for Angles Greater than 5° from the Main Beam Axis for the High Performance Antenna

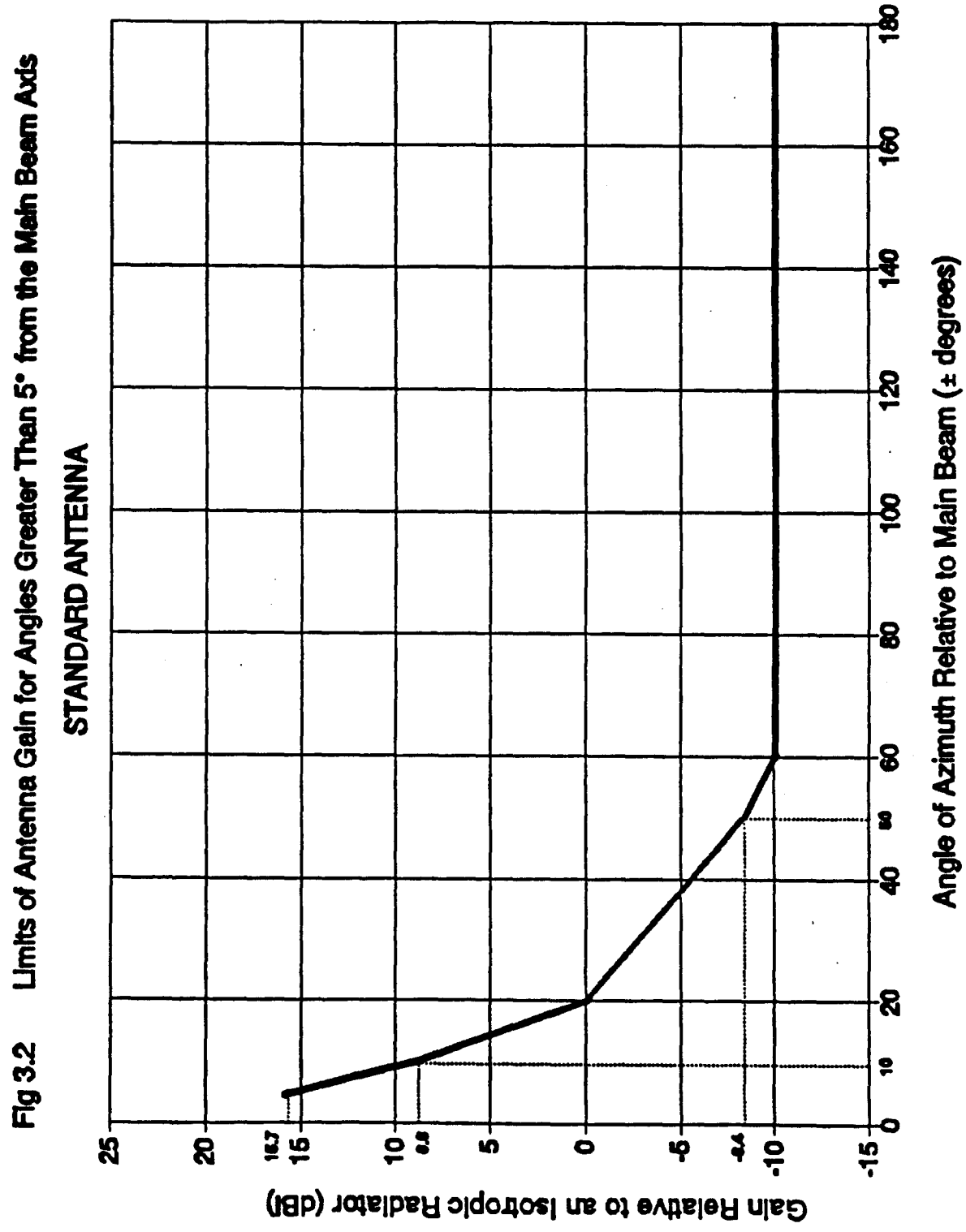


Fig 3.2 Limits of Antenna Gain for Angles Greater than 5° from the Main Beam Axis for the Standard Antenna

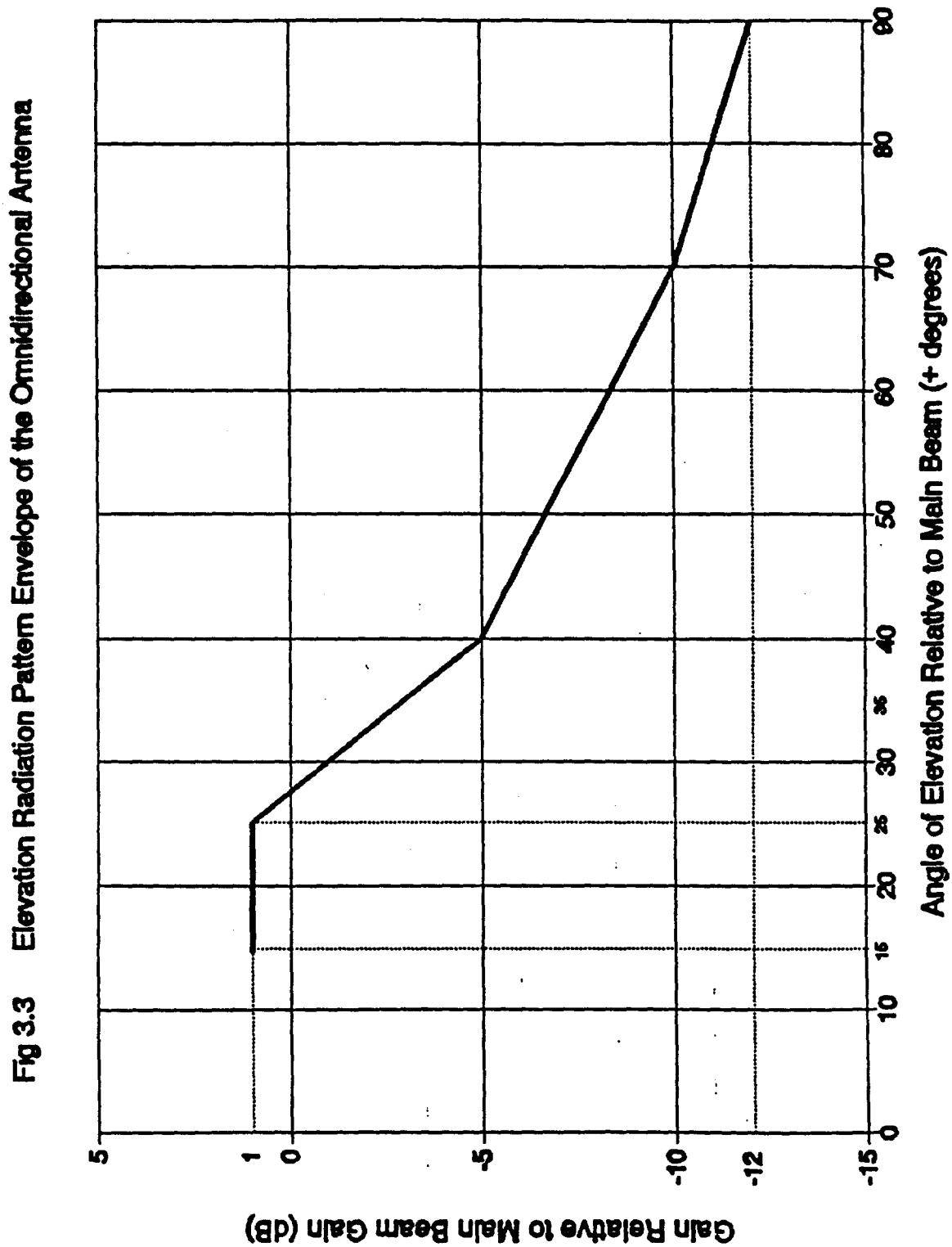


Fig 3.3 Elevation Radiation Pattern Envelope of the Omnidirectional Antenna

EX PARTE PRESENTATION

MPT 1415

Issue 11

PERFORMANCE SPECIFICATION

Performance Specification for
Fixed Link Radio Equipment and
Antennas operating in
the Frequency Band
57.2 GHz to 58.2 GHz

June 1991

500 MHz

This DRAFT has been modified to bring it in line with ETSI specifications.

1. It is required by the Wireless Telegraphy Act 1949 (as modified by the Post Office Act, 1969) that no radio apparatus shall be installed or used in the United Kingdom except under the authority of a licence granted by the Secretary of State. It is a condition of such a licence that the performance of the apparatus must meet certain minimum standards.

2. The minimum standards of performance are given in specifications prepared by the Radiocommunications Agency, in consultation with the relevant manufacturers and operators.

   For convenience, to avoid the need to test every piece of equipment, manufacturers are invited to make representative production models of their equipment available for testing by, or under the control of, Radiocommunications Agency.

   Manufacturers or their specified agents, who wish to submit equipment for type approval testing, should apply to:-

   Radiocommunications Agency
   Fixed Services Section
   Waterloo Bridge House
   Waterloo Road
   LONDON SE1 8UA
   Telephone: 071 215 2099

3. The application should state when and where the tests can be carried out and should be accompanied by a description of the apparatus, including drawings and test results obtained in the manner described in the appropriate performance specification.

   It should also list all type numbers that may apply to non-technical variants of the model submitted.

   The Radiocommunications Agency reserves the right to give separate type approval to models it considers to be technical variants, and whose performance may differ as between types.

4. The application specifications should be accompanied by the appropriate charge for type approval testing. Information on such charges is available from the above address.

5. Performance specifications are subject to amendment. Intending manufacturers should ensure they possess the latest copy of the relevant specification, complete with any amendments.

Part 1 PERFORMANCE SPECIFICATION

Private Fixed Link Radio Equipment for use in the Frequency band 57.2 to 58.2 GHz

Part 2 PERFORMANCE SPECIFICATION

Antennas for Private Fixed radio services operating in the band 57.2 to 58.2 GHz

Part 3 FREQUENCY BAND PLAN

For the band 57.2 to 58.2 GHz

Part 1

Performance Specification

Private Fixed Link Radio Equipment for use in the

Frequency band 57.2 GHz to 58.2 GHz

CONTENTS

			Page
1		GENERAL	3
	1.1	Scope of specification	3
	1.2	Users Responsibility	3
	1.3	Operating Frequencies	3
	1.4	Controls	3
	1.5	Declarations by Manufacturer	4
	1.6	Auxiliary Information	4
	1.7	Classes of Emission	4
	1.8	P.L.L. Systems	4
	1.9	Labelling	4
	1.10	Input and Output Port - Definitions	5
2		TEST CONDITIONS	6
	2.1	General	6
	2.2	Test Power Source	6
	2.3	Normal Temperature Conditions	6
	2.4	Extreme Test Conditions	7
	2.5	Procedure For Tests At Extreme Temperatures	8
3		CONTROL CONDITIONS	8
	3.1	Receiver Mute or Squelch Facility	8
	3.2	Transmitter Artificial Load	8
4		TRANSMITTER	9
	4.1	Frequency Error	9
	4.2	Carrier Power	9
	4.3	Spurious Emissions	10
5		RECEIVER	11
	5.1	Receiver Spurious Emissions	11
6		CABINET RADIATIONS	11
	6.1	Definition	11
	6.2	Specification Limits	11
7		INTERPRETATION OF THIS SPECIFICATION	12
8		ACCURACY OF MEASUREMENT	12

1 GENERAL

1.1 Scope of specification

This specification covers the minimum performance of fixed point-point and point-multipoint radio equipment operating in the frequency band 57.2 to 58.2 GHz. It does not necessarily include all characteristics which may be required by a user, nor does it necessarily represent the maximum performance achievable.

For the following requirements the equipment shall be measured complete with any appropriate peripheral devices and their connecting leads:-

- transmitter carrier power
- transmitter spurious emissions
- transmitter frequency tolerance
- receiver spurious emissions

Details of the minimum performance requirements of 60 GHz antennas are contained in Part 2 of this specification.

Requirements to bring the specification into line with forthcoming EEC EMC directives are under consideration.

1.2 Users Responsibility

The installation of equipment is subject to the authority granted by the Secretary of State. It will be the responsibility of the user to ensure that the equipment provided conforms with, and is maintained to, the requirements of the specification.

In addition, other requirements such as Health and Safety Regulations may be applicable. One example is power flux density; for equipment intended for operation indoors the minimum safe operating distance recommended by the manufacturer must be plainly visible.

1.3 Operating Frequencies

The equipment shall provide for the transmission and reception of emissions in the frequency band 57.2 to 58.2 GHz. For the purpose of type testing, the equipment may be submitted on a mutually agreed channel in the above frequency band.

1.4 Controls

Those controls which, if maladjusted, might increase the interfering potentialities of the equipment or, in particular, which might cause the equipment to operate outside the permitted frequency limits specified on the type approval certificate, shall not be easily accessible.

1.5 Declarations by Manufacturer

When submitting an equipment for type testing, the manufacturer shall supply the following information:

(a) Transmitter:

i) Nominal frequency
ii) Oscillator frequency and carrier generation formula
iii) Type of Modulation

(b) Receiver:

i) Nominal frequency
ii) Oscillator frequency and the local oscillator generation formula

(c) Power Supply

i) Nominal supply type and voltage

1.6 Auxiliary Information

Where appropriate, a means of supplying continuous modulation to the transmitter and complete instructions for setting up the correct modulation level must be supplied. This will be used for generating certain test signals.

1.7 Classes of Emission

Any class of emission may be used provided that the requirements of the specification are met.

1.8 P.L.L. Systems

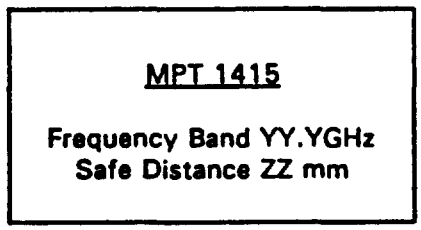
Where P.L.L. systems are used for carrier generation, precautions shall be taken to ensure that any lack of synchronisation does not cause deviation outside the permitted frequency limits specified on the type approval certificate.

1.9 Labelling

The equipment shall be provided with a clear indication of the type number and description under which it is submitted for type testing. The type number must allow recognition of the multiple unit type of assembly. Each type number shall be unique and in the event that the testing authority finds two manufacturers have used a similar type number, one manufacturer will be asked to change the type number.

Type approved equipment shall be permanently marked with an approved Inspection mark which shall be located on the outside of the equipment and be immediately visible. The minimum dimensions of the Inspection mark shall be 10 x 15mm. The location of the Inspection mark shall be agreed between the manufacturer and the testing authority and shall be recorded in the test report.

The mark used to indicate compliance shall be as shown in Figure 1.1.



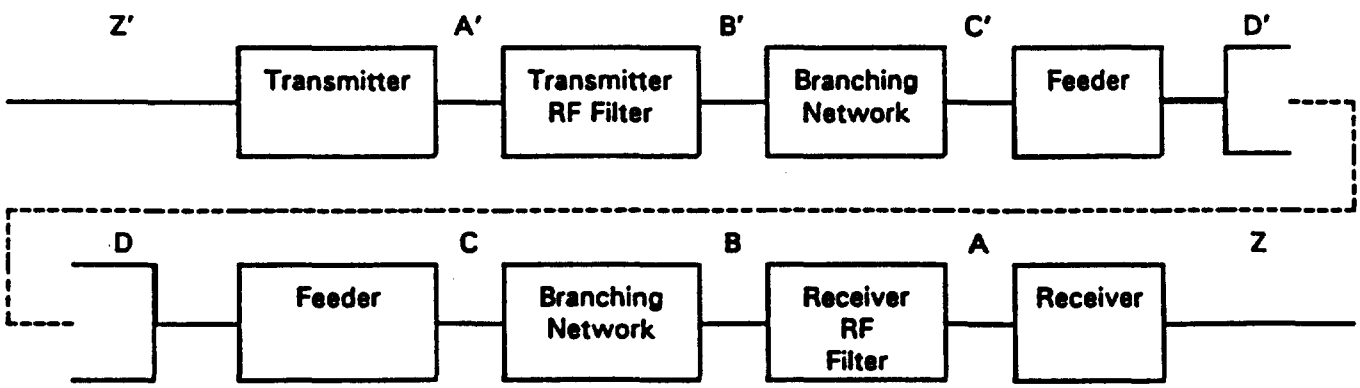
Letter and figure height shall not be less than 2mm.

Figure 1.1

1.10 Input and Output Port - Definitions

1.10.1 For the purpose of the specification the terms "transmitter input port", "receiver input port", "transmitter output port" and "receiver output port" shall be taken to refer to those points corresponding respectively to the ports Z', C, C' and Z in Figure 1.2. Points Z' and Z are baseband input and output points respectively.

1.10.2 Accessibility for measuring R.F. power is referred to in Section 2.1.



Note 1. For the purpose of defining the measurement points, the branching network does not include a hybrid.
Note 2. Points B, C, D and B', C', D' may coincide.

Figure 1.2 RF Block Diagram

2 TEST CONDITIONS

2.1 General

Type approval tests shall be made under normal test conditions (Section 2.3) and also where stated, under extreme test conditions (Section 2.4).

Where the equipment is intended to be part of an integral radio equipment and antenna configuration, the radio equipment submitted for the test shall be identical to that employed in the integral arrangement except that it is separated from the antenna and fitted with a suitable waveguide flange or connector to form a test interface. Connection to this test interface will allow equipment performance to be measured.

Alternative measurement methods for the testing of integral equipment without separating the radio equipment from the antenna may be proposed. Full details of the method and limits together with supporting technical evidence shall be given in writing to the type approval authority at least four weeks prior to the tests. The use of such methods and limits are subject to the agreement of the type approval authority.

2.2 Test Power Source

During type approval tests, the power supply for the equipment may be replaced by a test power source capable of producing normal and extreme test voltages, as specified in Clauses 2.3.2 and 2.4.2.

The internal impedance of the test power source shall be low enough for its effects on the test results to be negligible. For the purpose of type approval tests, the supply voltage shall be measured at the input terminals of the equipment. If the equipment is provided with a permanently connected power cable, the test voltage shall be measured at the point of connection of the power cable to the equipment.

During the tests the power source voltage shall be maintained within a tolerance of ± 3% relative to the voltage at the beginning of each test. In equipment in which batteries are incorporated, the test power source shall be applied as close to the battery terminals as practicable.

2.3 Normal Temperature Conditions

2.3.1 Normal Temperature and Humidity

The normal temperature and humidity conditions for tests shall be any convenient and naturally occurring combination of temperature and humidity within the ranges:-

Temperature	+15°C to 35°C
Rel. Humidity	20% to 75%

Note. When it is impracticable to test under these conditions, a note to this effect, stating the actual temperature and relative humidity during the tests, shall be added to the test report.

2.3.2 Normal Test Source Voltage

2.3.2.1 Mains Voltage

The normal test source voltage for equipment to be connected to the mains shall be the nominal voltage. For the purpose of this specification the nominal voltage shall be any of the declared voltages for which the equipment is designed. The frequency of the test source corresponding to the AC mains shall be 50 Hz ±2 Hz.

2.3.2.2 Float Battery Power Sources

When the radio equipment is intended for operation from a float battery, the normal test source voltage shall be the typical float voltage of the battery.

2.3.2.3 Other Power Sources

For operation from other power sources or types of battery, either primary or secondary, the normal test source voltage shall be that declared by the manufacturer.

2.4 Extreme Test Conditions

2.4.1 Extreme Temperature and Humidity

For test purposes the equipment shall be required to meet the relevant environmental conditions set below:

(a) Indoor equipment

Temperature	+5°C to +40°C
Humidity	5% to 85%

(b) Outdoor equipment

Temperature	-20°C to +40°C
Humidity	5% to 90%

N.B. The conditions laid down in Clause 2.4 do not apply to antennas.

2.4.2 Extreme Test Source Voltages

2.4.2.1 Mains Voltage

The extreme test source voltage for equipment to be connected to an AC mains source shall be 1.1 and 0.9 times the nominal mains voltage ±10%. The frequency of the test source shall be 50 Hz ±2 Hz.

2.4.2.2 Battery Power Sources

When the equipment is intended for operation from the usual type of regulated lead-acid battery, the extreme test voltage shall be 1.3 and 0.9 times the nominal voltage of the battery specified for the equipment.

2.5 Procedure For Tests At Extreme Temperatures

2.5.1 General

Before making measurements, the equipment shall be placed in a temperature controlled chamber for a period of one hour or for such a period as may be judged necessary for thermal balance to be obtained. The equipment shall be switched off during the temperature stabilisation period. The sequence of tests shall be chosen and the humidity content in the test chamber shall be controlled so that excessive condensation does not occur.

2.5.2 Test Procedure

For tests at the upper temperature, after thermal balance has been attained (Clause 2.5.1), the equipment shall be switched on in the transmit condition for half an hour, after which the appropriate tests shall be carried out.

For tests at the lower temperatures, after thermal balance has been attained (Clause 2.5.1), the equipment shall be switched on in the receive or transmit condition for 30 minutes, after which the appropriate tests shall be carried out.

3 CONTROL CONDITIONS

3.1 Receiver Mute or Squelch Facility

If the receiver is equipped with a mute or squelch circuit, this shall be made inoperative for the duration of the type approval test.

3.2 Transmitter Artificial Load

Tests on the transmitter shall be carried out using a non reactive non-radiating load connected to the transmitter radio frequency output port. The load shall have a return loss of not less than 23 dB.

4 TRANSMITTER

4.1 Frequency Error

4.1.1 Definition

The frequency error of the transmitter is the difference between the measured carrier frequency and its nominal value.

4.1.2 Method of Measurement

(a) The transmitter shall be operated in accordance with the manufacturer's instructions and its output shall be connected to an artificial load (Section 3.2).

(b) The emission shall be monitored by a frequency counter and the carrier frequency shall be measured in the absence of modulation.

(c) The measurement shall be made under normal tests conditions (Section 2.3) and repeated under extreme conditions (Clauses 2.4.1 and 2.4.2 applied simultaneously).

4.1.3 Limits

The frequency error, under both normal and extreme test conditions shall not exceed ±600 ppm.

4.2 Carrier Power

4.2.1 Definition

The carrier power of a transmitter is the average power supplied to the antenna transmission line by a transmitter during one radio frequency cycle taken under conditions of no modulation (C.W. conditions).

4.2.2 Method of Measurement

(a) The transmitter output port shall be connected to an artificial load (Section 3.2) with means of measuring the power delivered to this load.

(b) In the absence of modulation (i.e. CW conditions), the transmitter shall be operated in accordance with the manufacturer's instructions.

(c) The measurement shall be made under normal test conditions (Section 2.3) and repeated under extreme test conditions (Clauses 2.4.1 and 2.4.2 applied simultaneously).

4.2.3 Limits

The carrier output power shall not exceed -20 dBW under any conditions.

4.3 Spurious Emissions

4.3.1 Definition

Spurious emissions are emissions at frequencies which are outside the Necessary Bandwidth and the level of which may be reduced without affecting the corresponding transmission of information. Spurious emissions include harmonic emissions, parasitic emissions, intermodulation products and frequency conversion products but exclude emissions on frequencies immediately outside the Necessary Bandwidth which result from the modulation process. The Necessary Bandwidth is defined as twice the transmitted symbol rate.

4.3.2 Method of Measurement

(a) The transmitter output port shall be connected to either a spectrum analyzer via an attenuator, or an artificial load with some means of monitoring the emission with a spectrum analyzer or selective voltmeter.

(b) The transmitter shall be unmodulated, (i.e. C.W. conditions). At each spurious emission from 1 GHz to 130 GHz excluding frequencies within the Necessary Bandwidth about the carrier frequency, the level of the emission shall be measured relative to the level of the carrier emission.

70MHz TO 1GHz CERTAIN

(c) The power level of each emission shall be calculated by applying the ratio measured in Clause 4.3.2 (b) to the carrier power determined in Section 4.2 under normal test conditions.

4.3.3 Limits

The power of any spurious emission measured in Clause 4.3.2(b) shall not exceed:

1.0 GHz to 21.2 GHz	-90 dBW
21.2 GHz to 80.0 GHz	-60 dBW
80.0 GHz to 130.0 GHz	-50 dBW

Note:

(a) Methods of measurement for the frequency range 80 GHz to 130 GHz are yet to be agreed with Administrations pending a decision by the IEC.

(b) Definitions and methods of measurement of integrated equipment are UNDER STUDY.

(c) In this specification, the necessary bandwidth will be taken as ± 45 MHz.

5 RECEIVER

5.1 Receiver Spurious Emissions

5.1.1 Definition

Spurious emissions from the receiver are any individual emissions present at its input port which is considered to be at the input of the receiver or diplexer if fitted.

5.1.2 Method of Measurement

(a) The receiver input port shall be connected to either a spectrum analyzer via an attenuator, or an artificial load with some means of monitoring the emissions with a spectrum analyzer or a selective voltmeter.

(b) The power level of each emission in the frequency range 1 GHz to 130.0 GHz, excluding frequencies within the Necessary Bandwidth about the carrier frequency, shall be measured.

5.1.3 Limits

(a) The power of any spurious emission from the receiver measured in 5.1.2 (b) including the local oscillator frequency generated by the receiver shall not exceed:

1.0 GHz to 21.2 GHz	-90 dBW
21.2 GHz to 80.0 GHz	-60 dBW
80.0 GHz to 130.0 GHz	-50 dBW

Note:

(a) Methods of measurement for the frequency range 80 GHz to 130 GHz are yet to be with Administrations pending a decision by the IEC.

(b) Definitions and methods of measurement of integrated equipment are UNDER STUDY.

(c) In this specification, the Necessary Bandwidth will be taken as ± 45 MHz.

6 CABINET RADIATIONS

6.1 Definition

Cabinet radiations are emissions at any frequency, other than those of the carrier and associated sidebands, radiated from the cabinet structure of the equipment.

6.2 Specification Limits

Cabinet radiations shall be minimised in order to avoid interference to other radio installations. In the event of interference being traced to cabinet radiations, the licensee will be required to provide interference suppression to a degree which satisfies the Radiocommunications Agency.

7 INTERPRETATION OF THIS SPECIFICATION

In the event of doubt arising over the interpretation of this specification, or the method of conducting the tests, the decision of the Testing Authority shall be final.

8 ACCURACY OF MEASUREMENT

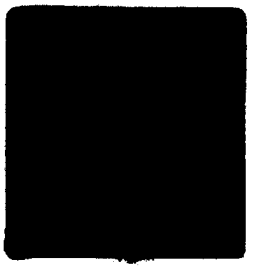
The tolerance for measurement of the quantities shown below will be as indicated.

8.1	DC Voltage	± 3%
8.2	AC Mains Voltage	± 3%
8.3	AC Mains Frequency	± 0.5%
8.4	Radio Frequency	± 100 kHz
8.5	Radio Frequency Power	± 1 dB
8.6	Return Loss	± 1 dB
8.7	Attenuation of Attenuators	± 1 dB
8.8	Temperature	± 1°C
8.9	Humidity	± 5%

PART 2

PERFORMANCE SPECIFICATION

ANTENNAS FOR PRIVATE FIXED RADIO SERVICES OPERATING IN THE BAND 57.2 GHz TO 58.2 GHz.



1 GENERAL

1.1 Scope of Specification

This specification covers the minimum performance requirements for vertically polarised antennas to be used in the frequency band 57.2 to 58.2 GHz allocated to Public Telecommunications Operators and Private Fixed Radio Services. Two types of antennas are included; a directional type and an omnidirectional type.

1.2 Licensee's Responsibility

The installation of equipment, either fixed or mobile, is subject to the issue of a licence by the Secretary of State. Under the conditions of the licence it will be the responsibility of the licensee to ensure that the equipment used conforms with and is maintained to the requirements of this specification. The requirement in this case is that the antenna shall be type-approved.

1.3 Labelling

Complete antenna assemblies shall be clearly identified with a weatherproof and permanent mark or marks showing the manufacturer's name and type number, the value of the gain declared in 1.4., the orientation required to achieve vertical polarisation and a statement of the minimum safe working distance so as not to exceed the maximum permissible power flux density in accordance with the current recommendations of the World Health Organisation when used with a transmitter with -20 dBW output power. ~~the orientation required to achieve vertical polarisation and a statement of the minimum safe working distance so as not to exceed the maximum permissible power flux density in accordance with the current recommendations of the National Radiological Protection Board when used with a transmitter with -20 dBW output power.~~

1.4 Declarations

When submitting an antenna for type approval, the manufacturer shall supply the following [information]:

(a) The nominal gain of the antenna, (note the value is the gain of the antenna type and not the gain of the particular sample).

(b) Whether a radome or feed-shroud is fitted to the antenna.

(c) Whether it is a directional or omnidirectional antenna.

(d) The working frequency range of the antenna.

1.5 Test Arrangements

All type-approval testing of antennas will be carried out at a test site specified by the testing authority. The testing shall be carried out on dry antennas.

If radomes are fitted (See 2.1 below) they shall be fabricated from materials which are as hydrophobic as possible, within cost and practicality constraints. Use of hydrophobic materials will minimise the effect of water droplets on the radiation pattern. Testing of antennas in rain conditions is under consideration. Arrangements

will be made for the applicant to deliver his antenna to the test site at least two weeks before testing is scheduled to begin.

Manufacturers may be required to participate in the mounting and dismantling of the antenna. Applicants will normally be expected to make arrangements to remove their antennas from the test site within 14 days of receiving notification from the testing authority that tests have been completed.

Note: Tests may from time to time be cancelled or postponed at short notice due to unsuitable weather conditions. Where the antenna is intended to be part of an integral radio equipment and antenna configuration, the test antenna will be identical to that employed in the integral arrangement except that it is separated from the radio equipment and fitted with a suitable waveguide flange or connector to form a test interface. Connection of test equipment to this test interface will allow antenna performance to be measured.

1.6 Polarisation

The polarisation of radiation shall be within 5 degrees of vertical.

1.7 Offshore Environment

Antennas to be used offshore shall additionally meet the environmental requirements of Chapter 2 of Radiocommunications Agency specification MPT 1405.

1.8 Interpretation of this Specification

In case of doubt about the interpretation of this specification the decision of the testing authority shall be final.

1.9 Testing authority

The testing authority shall be the Radiocommunications Agency or one approved by the Agency.

2 TECHNICAL REQUIREMENTS

2.1 Definitions

Radiation Pattern - A diagram relating power flux density or field strength at a constant and usually large distance from an antenna to direction relative to the antenna main beam (boresight).

Radome - A cover for the illuminated side of the reflector and the feed which is weatherproof and is intended to be transparent to radio frequency energy.

Co-polar pattern - A diagram representing the radiation pattern of the test antenna when the reference antenna is similarly polarised, scaled in dBi or dB relative to the measured antenna gain.

Beam axis - The direction, within the major (main) lobe of a narrow beam antenna, for which the radiation intensity is a maximum. This direction is also known as the antenna boresight.

Major/main lobe - The radiation lobe containing the direction of maximum radiation.

Antenna Beam - The major (main) lobe of the radiation pattern of an antenna.

Antenna gain - The ratio of power measured in the boresight direction to the level that would exist if the radiated energy (if the test antenna was considered to be in transmit mode) was uniformly distributed over a sphere centred on the test antenna, i.e. an isotropic radiator radiating the same power as the test antenna. The antenna gain is expressed in dB above isotropic level and is denoted by dBi.

2.2 Directional Antenna

This section describes the approval test requirements, method of measurement and specification limits for the directional antenna.

2.2.1 Approval Test Requirements

Approval tests will be conducted on the following antenna performance parameters:

a) Gain

b) Radiation Pattern

The values measured during the approval tests will meet the limits outlined in Clause 2.2.3, below.

2.2.2 Method of Measurement

Measurements shall be made at the test frequencies 57.2 GHz, 57.7 GHz and 58.2 GHz. The testing authority reserves the right to test at additional frequencies within the frequency band should it be deemed necessary. If the antenna is designed for use with a radome or feed shroud, then measurements shall be made with this in place.

(a) Gain

The antenna gain will be measured using the gain-by-comparison technique in which the gain of the antenna under test is compared with that of a calibrated gain antenna, typically a standard gain horn. In practice this will involve comparing the peak received power level of the directional antenna with the peak (boresight) level received from the horn. The gain of the antenna under test is the sum of the gain of the standard gain horn and the difference in observed peak power levels and is expressed in dBi.

Alternative methods can be proposed, providing the testing authority is satisfied that sufficient supportive evidence as to the suitability of the method of gain measurement has been provided and agreed with the testing authority at least 4 weeks prior to the approval test.

(b) Radiation Pattern

The co-polar pattern shall be measured and plotted at each test frequency with the antenna polarised in the vertical plane.